



MET TOWER RESITING

Met Tower, Substructure, and Foundation

Technical Memo

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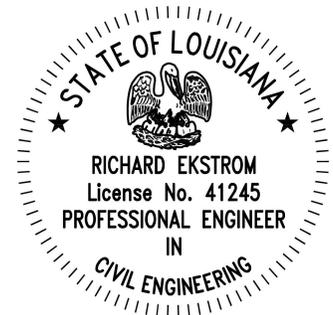


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1 INTRODUCTION

Keystone Engineering Inc. (Keystone) was requested by US Wind to provide preliminary assessment for relocating the Met Tower for the MarWin Offshore Wind Farm to a new proposed location within the lease area. The met tower was designed by Keystone Engineering in 2018 and fabricated by Gulf Island Fabrication and is currently located at the MARS facility in Houma, LA, see Figure 1-1.



Figure 1-1 Met tower and substructure at MARS Facility - Sep 2021

US Wind provided new site information to Keystone for review and this memo summarizes the findings of this assessment. This memo is intended to be submitted to BOEM as a part of the Construction and Operations Plan (COP) to communicate the impacts of the new proposed site on the existing design.

As a part of this task, Keystone is responsible for a site inspection of the substructure and met tower to ensure no significant structural damage has occurred during the storage period or due to the recent extreme weather events in Houma, LA. Therefore, the findings of this assessment are subject to change contingent upon the site inspection results. Keystone was provided with an inspection report performed by US Wind in December 2020 and no major issues were noted.

The original and newly proposed locations for the met tower are shown in Figure 1-2 and Table 1-1 shows the coordinates and water depths based on the available bathymetry information.

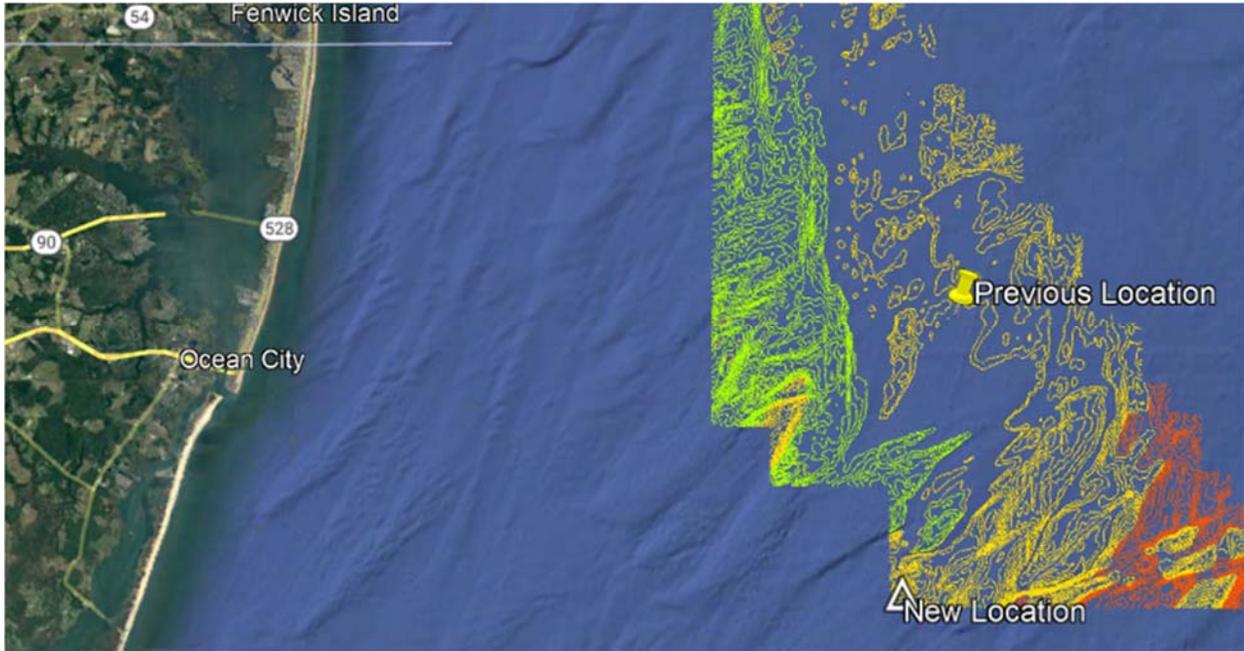


Figure 1-2 Original vs New Proposed Location of Met Tower

Table 1-1 Original vs New Proposed Location of Met Tower

Original	BH-MT	38.352747	-74.753546	27.0m (88.6ft)
New Proposed	BH-I21	38.252352	-74.777755	24.0 m (78.7ft)

2 DESIGN

The met tower substructure is a braced caisson which consists of a main caisson steel pile of 1.80 m (72 inch) diameter and two bracing piles each 1.20 m (48 inch) diameter. A steel deck will be installed on top of the substructure offshore and will be followed by the installation of a galvanized steel lattice mast onto the deck.

Keystone reviewed the available site-specific information for the new proposed location and compared them with the information from the original design. Table 2-1 summarizes the comparison results of the original and the new design criteria.

Table 2-1 Design Criteria Comparison

Design Criteria	Original Location	New Proposed location	Comment
Water Depth	27.0 m	24.0 m	Shallower site
Metocean Assessment	A.H. Glenn Report [2] [3]	A.H. Glenn Report [2] [3]	An additional metocean study [4] was conducted and the design parameters were determined to be less onerous. The original design parameters will be used as a conservative approach.
Soil	Fugro Geotechnical Report [5]	<i>Pending site specific soil boring data</i>	New site-specific soil characteristics are not expected to change significantly. Scour allowance was included in the design and needs to be re-evaluated once new soil information and sediment transport study are available
Substructure and Foundation (Primary Steel)	Substructure and Foundation Design Basis [6]	Substructure and Foundation Design Basis [6] with updated geotechnical data.	See discussion in section 3 of this memo

Substructure and Foundation (Secondary Steel)	Substructure and Foundation Design Basis [6]	<i>Pending US Wind requirements</i>	Minor changes are expected to the upper access platform per US Wind requirement – not reviewed in the current assessment
Met tower	Met Tower Design Summary [7]	<i>Pending US Wind requirements</i>	Minor equipment changes are expected per US Wind requirement – not reviewed in the current assessment

At the time of this review, the only available geotechnical information besides the original design data is a site characterization report by McNeilan and Associates [8]. Based on a review of nearby soil boring logs [9] [10] and the site characterization report [8], the development site appears to have a fairly uniform soil (except for occasional boulders) and the new proposed location is not expected to have significantly different soil parameters that would require design changes. However, the met tower substructure and foundation need to be re-evaluated once additional soil boring and site-specific data are available later this year.

3 FABRICATION

Based on the currently available information, Keystone does not anticipate any major fabrication effort for the new proposed location. The only expected changes are caisson and pile length adjustments in order to accommodate the new shallower location. This assumes that the new site would exhibit similar soil characteristics as the original location which appears to be likely.

Based on Keystone’s evaluation, the caisson and piles need to be shortened by about 3 meters. This modification is planned to require minimal fabrication and welding efforts.

Once the caisson and piles are modified, the resulting elevations (including boat landing and cathodic protections) and overall configuration (including pile embedment length) will be identical to the original design.

4 INSTALLATION

As discussed in the previous sections and due to the minimal design changes expected, Keystone does not anticipate any major deviation from the defined installation procedures in the SAP [1] (submitted by US Wind to BOEM on April 2, 2016) and are still applicable for the new proposed location.

5 CVA REVIEW

Braced caisson is a common type of substructure for offshore structures in the Gulf of Mexico and the fabrication and installation expertise of this structure type is relatively mature. The braced caissons used in the Oil and Gas industry are typically installed in relatively shallow water and do not require CVA review per the CFR 30 requirements. In addition to the engineering design, Keystone provided oversight during the fabrication of the met tower and substructure and no significant deviations from the original design occurred. Therefore, a CVA review for the met tower substructure and foundation would not be necessary, however, the final decision shall be made by US Wind.

REFERENCES

- [1] US Wind, "Site Assessment Plan - Maryland Offshore Wind Project," April 7, 2016.
- [2] A.H. Glenn and Associates, "500 year storm wind, tide, wave and current characteristics, and combined wave - current forces:88.6ft (27m) mllw depth: offshore Maryland," Oct 2015.
- [3] A.H. Glenn and Associates Services, "50 year storm wind, tide, wave and current characteristics, and combined wave - current forces:88.6ft (27m) mllw depth: offshore Maryland," Oct 2015.
- [4] K2 Management Inc. , "Maryland OWF - Design Basis," April 2021 .
- [5] Fugro-McClellan Marine Geosciences, "Engineering Analysis Boring: Met Tower Maryland Wind Energy Area, Offshore Maryland, Report No. 0201-7893," Nov 2015.
- [6] Keystone Engineering Inc., "Substructure and Foundation Design Basis Rev. 0," February 26, 2016.
- [7] Keystone Engineering Inc., "Met Tower Design Summary Rev. A," March 2, 2016.
- [8] McNeilan & Associates, "Initial, Integrated Geophysical & Geotechnical (G&G) Site Characterization Report," 2020.
- [9] Gardline, "Geotechnical Marine Survey Investigation for the Maryland Wind Energy Area Volume 2: Geotechnical Results Report, Draft," July 2015.
- [10] Gardline, "Geotechnical Marine Survey Investigation for the Maryland Wind Energy Area," July 2015.